Cooler Structure for Surface Cooling

The present invention relates to a cooler structure for cooling a surface and more particularly to a cooler structure suitable for cooling a vehicle windscreen.

In hot ambient conditions (particularly in climates having strong sunshine) vehicle windscreens can reach high temperatures frequently in excess of 50°C and on occasions up to 90°C plus. In such high temperature conditions it is a known problem that small windscreen breaks or cracks can become elongated (or result in shattering of the windscreen) when stresses are applied to the windscreen. This phenomenon is known in the art as 'cracking off'. Cracking off may occur when pressure or stresses are applied by crack or break repair devices which are mounted to the vehicle windscreen to repair a crack or break in such hot ambient conditions. Such a device is disclosed in WO-A-0134373.

An improved apparatus and technique have now been devised for such situations. According to the invention, there is provided a cooler structure for use in cooling a surface, the cooler structure comprising a backing panel and, supported on the backing panel, cooling medium in heat transfer relationship with the backing panel.

The cooler structure beneficially has a zone (access zone)

within its periphery through which a target zone of the surface (such as a zone of a windscreen having a crack or break) may be accessed. This zone of the structure (the accessible zone) is beneficially bounded by a cooling zone of the structure having the cooling medium supported on the structure. The target zone is beneficially accessed by a removable (or at least partially displaceable) portion of the cooler structure, such as a fold-back flap or the like which may be cut through the backing panel of the cooler structure. Beneficially the removable or displaceable portion carries cooling medium such that when the relevant portion is in place adjacent and contacting the surface (windscreen) the target zone is also directly cooled.

The removable or displaceable portion may be removed or displaced to permit the target zone to be accessed (and the repair process conducted) whilst the remainder of the structure remains in cooling contact with the surface (windscreen). The access zone is beneficially dimensioned to permit windscreen repair apparatus to be placed on a vehicle windscreen whilst the cooler structure is in place.

The cooling medium is beneficially present over an area of the cooler structure corresponding to substantially 60% or more (more preferably 70%, more preferably still 80%) of the backing panel.

The backing panel is beneficially substantially liquid impermeable and preferably comprises a plastics or rubber material such as for example PVC. Beneficially the backing

panel comprises a flexible sheet material which is conformable to the shape of the surface (for example the curvature of a vehicle windscreen).

It is preferred that the cooling medium comprises a material to be hydrated (or an already hydrated material). The cooling medium beneficially comprises an absorbent polymer material, preferably a superabsorbent polymer material such as for example a polymer obtainable under the trade name Hysorb M 7055 (BASF). Beneficially the cooling medium is in granular, particulate or hydrogel form.

The cooling medium is beneficially contained within pockets defined and formed on the structure. Discrete pockets effectively permanently retaining dosed quantities of the cooling medium.

The pockets beneficially have a front panel portion, beneficially comprising liquid permeable material. The backing panel preferably defines the opposite panel of the relevant pocket. The pockets are preferably formed by weld seams along face adjacent face sheets comprising the pockets.

Beneficially the structure is provided with mounting means for securing the structure in position on the surface. In one embodiment the mounting means may comprise one or more sucker cups, preferably provided along an upper portion of the cooler structure.

According to a second aspect, the invention provides a method of cooling a surface (particularly a vehicle windscreen), the method comprising positioning a cooler structure as defined herein, in position with the backing panel of the cooler structure adjacent the surface/windscreen.

According to a further aspect, the invention provides a method of repairing a flaw (such as a crack or break) in a vehicle windscreen, the method comprising positioning a cooler structure in position with a backing panel of the cooler structure in contact with the windscreen; permitting a period of time to elapse; and carrying out a repair process on the flaw.

Beneficially the cooler structure has a zone within the periphery of the cooler structure which zone is positioned over the flaw in the windscreen and through which zone the flaw of the windscreen may be accessed. Beneficially the repair process is carried out on the flaw whilst the cooler is in situ, positioned on the windscreen.

Beneficially the cooler structure includes temperature indicating means arranged to indicate the local temperature of the surface (e.g. windscreen).

According to a further aspect, the invention provides a method of manufacturing a cooler structure, the method comprising welding a liquid permeable sheet material to a liquid impermeable backing along weld lines to form a

series of pockets containing a cooling medium retained in the pockets.

According to still a further aspect, the invention provides a kit comprising a cooler structure as defined herein and a carrier container for containing the cooler structure, typically in the hydrated state. Beneficially the kit further includes a container for dispensing hydrating liquid to hydrate the cooler structure. The container for the cooler structure may also contain the hydrating liquid container.

The invention will now be further described in specific embodiment by way of example only and with reference to the accompanying drawings, in which:

Figure 1 is a schematic plan view of a cooler according to the invention;

Figure 2 is a schematic sectional view along Z-Z in Figure 1;

Figure 3 is an enlarged view of detail Y in Figure 1; and

Figure 4 is an enlarged view of detail X in Figure Z.

Referring to the drawings, a cooler 1 particularly suited for cooling a zone of a vehicle windscreen, comprises a flexible PVC backing layer 2 and a top sheet 3 of a non-woven polyester material overlaying the backing. A second

PVC layer sheet comprising marginal portions 4a, 4b, 4c and 4d and having a square central opening is laid over the non-woven polyester sheet 3. The layer structure is then welded using high frequency welding along a peripheral weld line 5 (extending around the entire perimeter of the cooler and along the internal edges of the marginal portions 4a, 4b, 4c to produce a peripheral weld line 6 defining a square boundary with the polyester top sheet 3. High frequency welding is also used to weld the polyester top sheet 3 to the backing layer 2 along parallel top to bottom weld lines 7, 8 and side to side parallel weld lines 9, 10. The polyester top sheet 3 is liquid permeable and is not stretched tightly across the backing layer 2 prior to welding in order to ensure the top sheet 3 can separate or pull away from the backing layer 2. In this way, when welded as described, the top sheet 3 together with the backing layer 2 forms a series of discrete pockets 11, 12, 13, 14, 15, 16, 17, 18, 19 into which liquid may pass via the top sheet 3. Prior to the welding stage granules 30 of a superabsorbent polymer gel material are placed in the zone of the pockets 15 to 19 intermediate the backing PVC layer 2 and the polyester top sheet 3. Typically, the polymer gel granules 30 are contained within soluble packets for ease of manufacturing. When the pockets are created by the welding process, the polymer gel granules 30 are effectively constrained within respective pockets 11 to 19.

When welding the top sheet 3 to the PVC backing layer 2, three lengths of over-wide weld line 7a, 8a, 10a are

produced. Centrally of the over-wide weld line lengths 7a, 8a, 10a a continuous cut line 20 is formed extending from a first cut-line end 21 to a second cut-line end 22. Cut line ends 21 and 22 are defined by small circular apertures cut through the welded portion of the cooler. A flap or opening pocket 15 is thereby defined which may be folded back along welded seam 9 to reveal an aperture extending completely through the welded layer arrangement of the cooler. The facility to fold back flap pocket 15 is shown most clearly in Figure 2 where the folding back pocket 15 is shown in dashed lines. The purpose of the folding pocket is explained in detail below. It should be noted that the fold back pocket is surrounded by other pockets. The top triangular peripheral zone of the cooler 1 is provided with three plastic suckers 24, 26, 27 enabling the structure 1 to be mounted to the windscreen surface to be cooled with the backing layer 2 in contact with the windscreen surface. The suckers are mounted through respective apertures with a push fit stank 28.

The purpose of the cooler structure is to enable a windscreen to be cooled from a high ambient temperature condition to a cooler condition for apertures such as windscreen crack repair. As previously mentioned, in hot or sunny climates or ambient conditions, vehicle windscreens can reach high temperatures, frequently in excess of 50°C and on occasions up to 90°C and above. In such high temperature conditions, it is a known problem that small windscreen breaks or cracks can become elongated when stresses are applied to the windscreen. Such

occurrences are referred to as 'cracking off'. Such cracking off can occur when crack or break repair devices are mounted on the windscreen to repair a crack or break. WO-A-0134373 discloses device for use in repairing windscreen cracks or breaks by infilling with resin. The device rests on the surface and applies vacuum pressure to the crack or break. In so doing, the stress applied to the windscreen can result in 'cracking off' in hot ambient conditions. The repair of what should have been a minor windscreen crack or break is therefore transformed into a more major repair job or even replacement of the screen. This is a technically more difficult, time consuming and expensive procedure. The cooler structure of the present invention enables 'cracking off' situations to be avoided even in very hot ambient conditions.

The cooler structure 1 is first either completely immersed in water to hydrate the superabsorbent polymer granules 30 in the pockets 11 to 19. The hydrated granules 30 expand to pad out the relevant pockets. The granules are manually spread out evenly through the relevant individual pockets. Following immersion in water, top up water may be added to maintain the hydration of the granules present in the pockets. The non-woven top sheet 3 material is water permeable. The PVC backing layer 2 is water impermeable.

Next the surface of the PVC backing layer is wiped dry. It is important to keep moisture away from the break or crack zone of the windscreen. The cooler structure is then place on the vehicle windscreen with the surface of the backing

layer 2 in contact with the screen. The fold back pocket 15 is centered over the crack or break zone of the windscreen. Folding back the pocket 15 enables the crack to be observed whilst positioning the cooler structure 1 on the windscreen. The suckers 25, 26, 27 hold the structure in place on the screen. With the cooler structure in place on the screen, the central fold back pocket is folded to its closed position and the structure left in place for a fixed period (typically 5 - 10 minutes or so) to lower the temperature of the windscreen. The fold back pocket 15 carries an LED thermometer 51 which is visible from externally of the structure in order to provide indication of the local surface temperature of the windscreen.

In trials, the cooler structure 1 has been shown to reduce the screen temperature by up to 35°C in 6 minutes, depending upon the screen start temperature. The mechanism for cooling is heat transfer from the screen via the PVC backing layer 2 to the wet gel material 30, which is at a lower temperature than the screen. Additionally, the ambient hot conditions cause the water held by the gel material 30 to evaporate producing an added cooling effect on the gel material due to evaporation. The gel material in the pockets can have water added as required by sinking through the top sheet layer 3.

Following cooling, the central fold back pocket 15 is folded back and the break is repaired. For example, a vacuum resin repair apparatus as disclosed in WO-A-0134373 can be applied to the windscreen to repaid the crack or

break. The pockets surrounding the folded back central pocket 15 remain in cooling contact with the windscreen during the repair process.

Following the successful completion of the repair, the cooler structure is removed from the screen, folded for storage in a sealed plastics carry case. The sealed carry case is useful for storing the structure in a damp or wet condition, keeping the polymer gel material in an at least partially hydrated condition.

In cooling from very hot conditions (screen temperature of 80°C or more) it has been found that with pocket 15 in place cooling the screen slight, slight extension of the crack can sometimes occur. The provision of a small aperture 30 (sealed at a weld seam) through the centre of the pocket 15 has been found to ameliorate this problem and aid positioning of the device, the crack or break being centered on aperture 30.

The invention has primarily been described in relation to cooling vehicle windscreens. Those skilled in the art appreciate however that the invention has application in other situations where cooling of a surface or structure may be required. Furthermore, the invention may also be of use in situations when temperature modification by heating may be required. The structure may in such circumstances be used to hold a heating material at higher temperature than the temperature of the surface to be heated. The pockets 15 may in such circumstances hold a material

arranged to selectively undergo an exothermic reaction to cause a heating effect.